

ENTOMOLOGY.—*The genus Oliarus and its allies in North America (Homoptera Fulgoridae).*¹ E. D. BALL, University of Arizona.

The writer started to prepare a food plant list of the western waxhoppers of the Fulgorid family *Cixidae* but soon found that, as usual, a considerable number of the species had apparently not been named. As opportunity afforded he has been taking up one genus at a time for preliminary revision in order to assign the new forms to their proper positions. One form was found that did not fit into any existing genus and the following genus is proposed for its reception.

Oliaronus Ball n. gen.

Intermediate in size and form between *Mnemosyne* and *Oliarus*. Resembling a large dark *Oliarus* with an extremely broad head and long, narrow, almost parallel margined elytra. Vertex very broad, but little longer than broad, almost parallel margined, the lateral carinae angled just in front of the middle and uniting before the apex, forming two large fovae. Front tumid, rounding over to vertex with only a trace of a carina, broad at the base and narrowly clasping the extremely long, oval, tumid clypeus. The ocellus visible and a median carina on front and clypeus indicated. Pronotum as short or shorter than in *Oliarus*, deeply angularly emarginate posteriorly and projecting into the angularly emarginate head. Mesonotum faintly 5 carinate. Elytra long and narrow with a smoky subhyaline membrane and strong dark nervures that are heavily setigerous throughout. Venation striking and distinctive. The subcosta (+R) approaching the costa which is thickened back to the stigma and the whole thickened area thickly beset with heavy setigerous punctures. The area between the subcosta and medius with scattering punctures in the central part. The stigma located anterior to the end of the clavus, the subcosta and radius both turning in, the subcosta capturing the radius about half way back from the stigma and thus forming a very broad area along the costa, which is divided into from 8 to 10 long narrow transverse cells. The female abdomen with a large wax plate.

Type of the genus *Oliaronus tontonus* n. sp.

Oliaronus tontonus Ball n. sp.

Superficially resembling *Oliarus pima* Kirk, slightly longer and narrower, much darker and more heavily setigerous; with a series of transverse veinlets back of the stigma. Length ♀ 10 mm, ♂ 8 mm, width ♀ 3.5 mm.

Structure of the genus, the vertex almost square, rounding over in front, face much narrower than in *O. pima* and more tumid. Pronotum very short, not more than half the length of that in *pima*, the carina closely margining the eyes. Elytra long, narrow, and appressed, the apical third slightly expanded, the costal margin with a slight angle near the base, the costal area back of this very narrow, darkened and heavily pustulate. The stigma very short and placed far forward, only a little farther from the base than the apex. Behind this in the expanded area are 8–10 long narrow transverse cells becoming more oblique as they approach the apex.

¹ Received February 28, 1934.

Color, dark smoky brown, the face, margins of vertex and often the mesonotal tablet testaceous; elytra smoky, the nervures black.

Holotype ♀, allotype ♂, and 10 paratypes Eloy, Ariz., Aug. 5, 1932, one Cline, Ariz. Aug. 2, 1929, all taken from mesquite by the writer; one paratype, Florence July 25, 1932 (Parker). The transverse cells in the expanded margins of the elytra will at once distinguish the species.

Genus OLIARUS Stal

The genus *Oliarus* was a difficult one for all early American workers because the amount of material available was very limited and fragmentary, many species being represented by a single individual or a single sex and good series from a single food plant unknown. Five species were named by the early workers. The writer described three western species in 1902. Fowler in the *Biologia* (1904) described nine new species without recognizing any of those previously described. His material was very limited, half of the species being described from a single sex. Van Duzee reviewed the United States forms in 1908 with the first key and added several species in 1912, and others later. Metcalf (1923) keyed out the species of the eastern United States and added four more.

The writer has been collecting material and attempting to determine food plants during the thirty years since his first paper, and now has good series of twenty-three and representatives of three others of the twenty-eight species here recognized as occurring north of the Mexican border. A study of long series of a number of species has brought out the fact that in this genus the females may be transversely banded, striped, or spotted but the corresponding males are nearly always plain or nearly so. This has not been previously recognized and has led to much confusion and synonymy.

A careful study of Fowler's descriptions and figures suggests the following disposition of his species; *O. excelsus* belongs to the *vicarius-placitus* group but cannot be placed accurately until a male is found. It appears to resemble *placitus* Van D. and examples of that species are at hand from Brownsville, Tex. *O. concinnulus* appears to be a distinct species occurring in the U. S. *O. propior* seems to be a distinct species of the broad headed group; the figure shows an extremely broad face. *O. lacteipennis*, poorly described without sex is apparently *complectus* Ball (1902). *O. humeralis*, equally poorly described from a female, is probably the same. *O. breviceps* described from a female is *aridus* Ball (1902) which occurs commonly around the Gulf. *O. chiriquensis* and *insignior* belong to the genus *Myndus* and are apparently distinct species in that group. *O. nigro-alutaceus* is a distinct species occurring north into Arizona.

Metcalf (1923) did not recognize the difference in color between sexes which is so striking in this group, nor did he consider the Fowler species and as a result redescribed *concinnulus* Fowl. as *texanus* from Brownsville. The writer took a good series there in Jan., 1932. Fowler's drawing of the genitalia is much better than Metcalf's figure. Metcalf apparently misidentified *diffi-*

cilis Van D. which was described from two females, as he figures the male genitalia as of the "hammer" type. The writer collected in central and southern Florida and at Brownsville, Tex. a small pale species the female of which exactly fits Van Duzee's description of *difficilis* and the male of Metcalf's description of *vittatus* (holotype male) from Brownsville. The allotype ♀ of *vittatus* described with the broad vitta was the female of *texanus* (which = *concinulus* Fowl.), while the true female of *vittatus* (which = *difficilis* Van D.) has the remnants of a transverse band as described by Van Duzee.

PRELIMINARY KEY TO THE SPECIES OF OLIDIUS

- A Female with more or less definitely transversely banded elytra (often three dashes on costal area). Verticies rather long, narrow, deeply sunken between high lateral carinae that are alternately light and dark. (Male genital projections sometimes greatly enlarged at apex.)
- B Male genital projection enlarged, plates hammer like.
 (Fla. Tex.) 1. *placitus* V.D. (N.C.) 2. *montanus* Metc.
- BB Male genital projection triangular.
- C Nervures all heavily dotted. Species large
 (SE) 3. *vicarius* Wk. (NE) 4. *quinquelineatus* (N.C.) 5. *vitreus* Metc.
- CC Nervures on the basal half of elytra pale, punctures scarcely showing. Species small
 (Fla. Tex.) 6. *difficilis* V.D. (Fla.) 7. *chuliotus* Ball
- AA Females with markings on elytra more or less linear (or oblique) or obscure (no dashes along the costal area, *exoptatus* excepted). Vertex variable, often broad and shallow, male genital projection never enlarged.
- D Species broad, often short and broad, the vertex as broad as long or not over one third longer than broad.
- E Elytra smoky. Females often with dashes along costa and occasionally a transverse band.
- F Elytra uniformly smoky, face definitely carinate.
 (NW) 8. *exoptatus* V.D.
- FF Elytra deep smoky, twice interrupted with white. Face tumid, polished. (Ariz.) 9. *papagonus* Ball
- EE Elytra hyaline, costal area immaculate.
- G ♀ 8-10 mm. Elytra milky, the nervures darkened but scarcely punctured.
- H ♀ 10 mm. Elytra with markings (Ariz.) 10. *pima* Kirk
- HH ♀ 8 mm. Elytra more or less ornamented.
 . . . ♀ (Ariz.) 11. *nogalanus* Ball (South) 12. *aridus* Ball
- GG ♀ 7 mm. or less. Elytra various.
- I General body color dark.
- J ♀ with a heavy zig zag pattern on elytra.
 (SW) 13. *californicus* V.D.
- JJ ♀ almost unmarked.
- K Face tawny with large spots.
 (Western 14. *hesperius* V.D. (Calif.) 15. *truncatus* V.D.
- KK Face black, unmarked. Stigma small.
 (Calif.) 16. *fidus* V.D.
- II General body color tan or lighter.
 (Colo.) 17. *sementinus* Ball

- DD Species more or less elongate, the vertex more than $\frac{1}{3}$ longer than broad.
- L Elytra hyaline or subhyaline, not deeply smoky.
- M Body dark (or brown). The nervures dark or dark punctured.
- N Elytra with the apical nervure and margin concolorous with the adjoining nervures.
- O The nervures of the elytra only faintly or sparsely dotted or else the nervures dark so that the punctures are obscure.
- P Front more than twice as broad across the antennae as at base. Faun colored with a pair of yellow spots. Large. (Fla.) 18. *slossoni* V.D.
- PP Face much narrower, not twice wider on antennae than at base, dark with the carinae light.
- Q Large (3 mm. broad) Dark with the nervures dark throughout. (Ariz.) 19. *corvinus* Ball
- QQ Smaller (2 mm. broad) paler or dark with the nervures pale.
- R Spine of anal segment of ♀ produced into an acute point extending into the genital cavity, 3rd antepical cell wanting, the fourth very broad at apex. Subtropical) 20. *complexus* Ball
- RR Anal segment of male without a spine extending into genital cavity.
- S 6 antepical cells, the third but little longer than wide (Ariz.) 21. *yavapanus* Ball
- SS 5 antepical cells the third wanting. (Ariz.) 22. *coconinus* Ball
- OO The nervures at the base of the elytra pale, heavily and evenly dotted.
- T Elytra slightly tawny or smoky, the dots and cross nervures not prominent. (Fla.) 23. *littoralis* Ball
- TT Elytra hyaline with heavy dots and cross nervures.
- U Vertex broad at base, the lateral fovae not half its length 24. *concinnulus* Fowl.
- UU Vertex narrow, the lateral fovae more than half its length. (Ariz. & Mex.) 25. *apache* Ball
- NN Elytra with the apical margins narrowly ivory; the nervures, at least on the apical portion, dark with heavy bristles. (Ariz.) 26. *altanus* Ball
- MM Body tawny, the nervures pale except at apex. (Arid W.) 27. *dondonius* Ball
- LL Elytra deep smoky or black, or at least the apical third dark.
- V Elytra all smoky.
- W Small (not 2 mm. wide) costal margin of elytra dark. (SW & Mex.) 28. *nigro-alutaceus* Fowl.
- WW Large (4 mm. wide) costal margin narrowly white. (North) 29. *cinnamomeus* Prov.
- VV Apical third of elytra deep smoky. (North) 30. *humilis* Say

Oliarus chuliotus Ball n. sp.

Size and form of *difficilis* Van D. nearly, slightly smaller and decidedly whiter. Length 4.5–5 mm.

Vertex slightly longer and narrower than in *difficilis*, the front much nar-

rower with the basal fork of the carina subobsolete, the front slightly longer than the clypeus, while in *difficilis* it is reversed. Mesonotum with the five carinae distinct, while *difficilis* shows only three. Male styles short and stout with a stout hook at right angles extending one third of their length beyond the short pygofer. In *difficilis* the styles are longer, the hooked portion shorter and stouter and the whole not extending beyond the elongated pygofer margins.

Color pale cinnamon brown above and below; the face without white spots, an elongated white spot on the carinae of vertex, the anterior foveae black, a dark brown area outside the lateral carinae of mesonotum. Elytra milky subhyaline over a dark abdomen; the apical third slightly smoky with the transverse nervures infuscated with brown; sometimes a brown cloud inside the stigma. In the females, an elongated black spot back of the middle of the commissure.

Holotype ♀ April 17, 1927, allotype ♂ Apr. 18, 1927, paratype females Apr. 17, 1927, and Apr. 15, 1928, all taken by the writer at Sanford, Fla. A female, Homestead, Fla., May 15, 1928. A male, Eustice, Fla. Apr. 6, 1926, taken by the writer and a male, Haw Creek, Fla., Oct. 8, 1887. Strikingly distinct in color and genitalia.

Oliarus papagonus Ball n. sp.

Resembling *exoptatus* Van D. but slightly smaller, darker with rather indefinite white bands across the elytra. Elytra smoky, face and mesonotum black, polished with the carinae obscure. Length 4–5 mm.

Vertex narrower than in *exoptatus* or *fidus* Van D., a little longer than wide, parallel margined instead of broadening behind as in those species. The basal tablet of vertex narrow and forming a long oval in front, instead of very broad and almost truncate before the tumid apex as in the species mentioned. The whole face evenly convex, polished with the carinae almost obsolete. Mesonotum broad, tumid, polished with obscure carinae. Elytra broad, short, with prominent nervures and heavy setigerous bristles. Male styles with the reflexed portion little wider than the shank and only slightly exceeding the pygofer, the dorsal membrane broad and elevated into a roof-like structure over the styles.

Color, dark smoky, with indistinct white bands across the elytra. Face and mesonotum shining black, the latter margined outside with white. Vertex dark, the carinae rather broadly light.

Holotype ♀, allotype ♂, and 13 paratypes Eloy, Ariz., June 3, 1933, all taken by the writer from a few mesquite trees growing in an area where *Lycium* sp. was abundant.

Oliarus nogalanus Ball n. sp.

Smaller and narrower than *pima* Kirk, the female more definitely ornamented, resembling *aridus* Ball but darker and more slender, much more heavily clothed with setigerous bristles than in either of the others. Length 6–8 mm., width 2 mm.

Vertex, within the carinae and omitting the foveae, as long as wide instead of wider than long as in *aridus* or nearly twice wider than long as in *pima*. Face slightly narrower than in *aridus*. Male styles with the shanks narrow and the hooked portion broad and roundly right angled, extending considerably beyond the short rounding lateral margins of the pygofer. The dorsal membrane very short and rounding with a slight elevation in the

center. In *aridus* the styles are acutely angled, the pygofers long and the dorsal membrane projects in a long triangle, while in *pima* the hook is still thicker and the dorsal membrane is both longer and broader.

Color brown; a pair of creamy spots on margins of face just below the antennae; the carinae of vertex and pronotum white, elytra in female slightly milky, the nervures dark, the bristles darker, with the forks and cross nervures marked with smoky, which in heavily marked individuals coalesces into two oblique bands toward the apex.

Holotype ♀, Nogales, Aug. 7, 1932, allotype ♂, Santa Rita Mts., July 19, 1931, and 14 paratypes taken with the types and from Douglas, Patagonia and Tucson. All taken by the writer in the mountains of Arizona.

Oliarus corvinus Ball n. sp.

Resembling *compectus* Ball, but larger and darker with heavy pilosity. Black with the carinae orange. Length 5–6 mm.

Vertex relatively long and narrow with the foveae long, slender, reaching the middle of vertex. Base of front narrower and more heavily carinate than in *compectus*. Pronotum larger and more heavily carinate than in *compectus*, elytra longer with the nervures darker and more heavily clothed with setigerous punctures. The third antepical either reduced or wanting, the fourth about as wide as the adjoining cells instead of much wider as in *compectus*. Male styles stout, the hook broad, evenly rounding, exceeding the truncate pygofers by nearly their width. Dorsal hood moderately broad and almost evenly rounding except for a slight central depression, instead of rather narrow and acutely produced into the genital cavity as in *compectus*.

Color black, all carinae broadly orange. Elytra hyaline or slightly smoky, the nervures dark and heavily clothed with dark hairs. Genitalia cinnamon.

Holotype ♀, allotype ♂, and 12 paratypes, Patagonia Aug. 8, 1932. This species is widely distributed in southern Arizona and is easily distinguished by its size.

OLIARUS COMPECTUS Ball

O. compectus Ball Can. Ent. 34: p. 152. 1902.

(*O. lacteipennis* Fowl. Bio. Cent. Am. Homop. Vol. 1, p. 93. 1904)

(*O. humeralis* Fowl. op. cit. p. 94)

(*O. franciscanus* V.D. Cat. p. 732 [Not Stal])

This species was described from 25 examples from Haiti, Md., Kans., Ariz., and Colo. The present study brings out the fact that there were at least two and probably three species included in the original material. In order to definitely limit it to the species intended in the original description, the holotype is fixed on a female from Port Au Prince, Haiti, and the allotype on a male from the same place, both examples so labeled and in the author's collection.

Thus limited the species may be known by the fact that the anal segment projects down into the genital cavity in the form of a median spine. Examples are at hand from Haiti, many places in Florida, southern Arizona and adjacent Mexico. Van Duzee places this species as a synonym of *franciscanus* of Stal, largely on size and distribution no doubt, as Stal's description is

purely generic. As there are at least four species treated in this paper that would meet these requirements, it seems best to consider Stal's species as unknown until such time as our west coast forms are better known and Stal's type can be critically studied.

Oliarus yavapanus Ball n. sp.

Resembling *complectus* but with a narrower vertex, and 6 antepicals, paler with smoky elytra. Length ♂ 4 mm.; ♀ nearly 6 mm.

Vertex twice longer than wide, the foveae scarcely half its length, the lateral carinae high, almost foliaceous. In profile the vertex and face form a slightly obtuse angle. Mesonotum with five definite carinae, the inner pair strongly sinuate and together with the outer pair enclosing an oval compartment posteriorly. Elytra long and slender, six apical cells the third little longer than wide. Male with the anal segment forming a narrow and uniformly rounding hood back of the long, narrow, angularly hooked, dark brown styles.

Color dark brown to black, the carinae broadly orange, elytra slightly smoky in females, rarely so in the males. The darkening emphasized on the apical cells. The nervures distinctly but not conspicuously punctured. The stigma not as prominent as in *complectus* or *corvinus*.

Holotype ♀, allotype ♂, and a pair of paratypes, Ashfork Aug. 16, 1929, six paratypes Ashfork July 15, 1929, three Yarnell Heights July 21, 1929, and two from the same place Aug. 20, 1929. All collected by the writer from the higher table lands or mountains of Arizona.

Oliarus coconinus Ball n. sp.

Stouter than *complectus* Ball, resembles *yavapanus* Ball, but with a broader vertex and only five antepicals. Female elytra heavily smoky posteriorly; male hyaline. Length ♂ 4.5 mm.; ♀ 5.5 mm.

Vertex broader behind than in *yavapanus* especially in the female. In profile the vertex meets the front in a right angle. Elytra long and slender with five antepical cells, the fourth scarcely broader than the others, the stigma elongate. Male anal hood broad on the lateral margins, deeply emarginate medially, where it is distant from the short, stout, bright yellow styles that terminate in round slightly divergent plates.

Color dark brown or black, the carinae narrowly orange. Elytra smoky in the female especially on the transverse nervures, hyaline in the male, nervures dark, sparsely and inconspicuously ornamented with setigerous punctures. A dark line along the median portion of the sutural margin.

Holotype ♀, allotype ♂, and one male paratype Williams July 13, 1929, a female Aug. 15, 1929, a female Flagstaff Aug. 7, 1929, and two males Huachuca Mts., Aug. 2, 1931, all taken by the writer from the table lands or mountains in Arizona.

Oliarus littoralis Ball n. sp.

Form of *complectus* Ball nearly, slightly shorter and stouter, resembles *sementinus* Ball in form and color, but with a much longer, narrower head. Pale brown with the carinae light; elytra pale tawny with the nervures punctured and darker towards apex. Length 4.5 to 5.5 mm.

Vertex and mesonotum about as in *yavapanus* Ball, the elytra with six antepicals, punctures on nervures strong and extending almost to base.

Male anal segment broad and emarginate as in *coconinus* Ball, the styles stout with long angularly reflexed heads.

Color, pale tawny; the vertex and mesonotum pale to dark brown with the carinae broadly light. Front and clypeus dark brown or darker, but with the carinae broadly light. Elytra tawny subhyaline, the nervures pale tawny and heavily punctured to the cross nervures beyond which they shade to smoky.

Holotype ♀, allotype ♂, and seven pairs of paratypes taken by the writer at Tampa, Fla. Sept. 10, 1927. This tawny species resembles *dondonius* but is much darker, with the styles broader and more hairy, the hood with the lateral flaps overhanging the genital chamber, while in *dondonius* the hood is only a marginal line. Besides the type set, the writer has taken this species in a number of places along the east coast of Florida.

OLIARUS CONCINNULUS Fowler

O. concinnulus Fowl. Bio. Cent. Am. Homop. Vol. 1, p. 92. 1904.

(*O. texanus* Metc. Journ. El. Mitch. Sci. Soc. 38: 181. 1923)

(*O. vittatus* (♀) Metc. Op. cit. 181. [Not holotype ♂])

This is a short broad species, (4–6 mm.), but the vertex is more than $\frac{1}{2}$ longer than its width. The elytra are milky with heavily punctured nervures, pale at the base but becoming dark beyond the cross nervures. The stigma is large and there are usually two black spots in an oblique line from it to the scutellum. The female often has a broad, longitudinal, slightly interrupted stripe near the inner margin of each elytron.

Habitat, Vera Cruz and Guerrero, Mexico (Fowler) and Brownsville, Texas. Fowler suggested that this species may have to be referred to *O. lunatus* Fab. as represented by material which the writer sent him. That material, however, represents a very distinct species.

Oliarus apache Ball n. sp.

Resembling *concinnulus* Fowl. in size and form, darker with a narrower vertex. Black with the carinae on head narrowly light. Elytra milky with close set, black punctures, each bearing a long curved black hair. Length 4–6 mm.

Vertex much narrower than in *concinnulus*, the fovae long, extending more than half way to base. Mesonotum with three, heavy, parallel carinae, the intermediate pair only faintly indicated. The anal segment much more extended than in *concinnulus*, the styles more slender and asymmetrical, the left one larger and slightly notched at apex.

Color black above and below, the carinae on vertex and pronotum narrowly light, a pair of white spots on the carinae between the eyes and another pair on the extended apical margins of the front. Mesonotal carinae concolorous or slightly orange, elytra milky, the nervures white throughout, except the marginal nervures, heavily and closely punctured with black and clothed with long curved black hairs. The forks and cross-nervures broadly black. The stigma coriaceous white except for aggregated punctures on the boundary nervure.

Holotype ♀, allotype ♂, and 4 paratypes May 15, 1933 and nine paratypes May 19, 1929, all taken by the writer at Tucson, Ariz. This strikingly

distinct species has been taken in the Creosote deserts around Tucson, at Patagonia and Tinajas Altas in Ariz. and near Hermosillo, Mexico.

Oliarus altanus Ball n. sp.

Resembling *apache* Ball, but longer, slenderer with extremely long narrow elytra, and coarse irregular veins that are definitely black in the apical region against the broad white margin. Length 5 mm.

Vertex slightly broader and deeper than in *apache*, the front longer and narrower. Elytra extremely long and slender, the inner fork of the radius approaching and paralleling the medius for some distance, nervures and cells in the apical portion tending to irregularity with the third apical narrow and curved. The stigmal cell extremely long and narrow, four times as long as its width.

Color, black, the bounding carinae, except on mesonotum, narrowly light, median carinae of front tawny, a pair of semi-circular white spots on the carinae adjacent to the eyes. Elytra milky white, the bounding nervure broadly white, the remaining nervures either all dark or dark spotted at base and all dark towards apex in striking contrast to the margin.

Holotype ♀, allotype ♂, and two male paratypes taken by the writer at Tinajas Altas, Ariz. May 17, 1932.

Oliarus dondonius Ball n. sp.

Resembling *sementinus* Ball in color, slightly smaller, but with a vertex one half as wide. Form of *yavapanus* Ball nearly, much paler with a pale stigma. Pale tawny with a castaneous mesonotum. Length 4.5–5.5 mm.

Vertex as in *yavapanus* nearly, the foveae narrowed, pronotum much shorter and rarely reaching the epaulets at the shoulders. Elytra slightly broader with only 5 anteapical cells and a narrow stigma, half longer than its basal width.

Color, pale tawny, the elytra paler. The face in the males, the lateral foveae and sometimes longitudinal stripes on the mesonotum, brown. Elytra with the nervures on the basal half indistinct, becoming tawny, towards the apex with the cross nervures smoky.

Holotype ♀, allotype ♂, and 10 paratypes, Tucson, Ariz. July 24, 1930, 4 paratypes, Grand Junction, Aug. 7, 1906, all taken by the writer on sea blite (*Dondia*). This species is common in alkaline areas from western Colorado through Utah to Arizona and Sonora, Mexico. It is a smaller and much narrower headed species than *sementinus* which it otherwise resembles.

ADVANCE SUMMARIES

BIOLOGY.—*Viability of bacteria in air.*¹ W. F. WELLS, Harvard School of Public Health. (Communicated by W. H. BRADLEY.)

A technique has been devised for study of the viability of droplet nuclei infection in air, by determining the differential disappearance rates in a controlled atmosphere of the infection and of the nuclei, and will be described more fully in a later publication. Preliminary experiments demonstrate that

¹ Presented before Section N. of the American Association for the Advancement of Science, Dec. 27, 1933. Received April 24, 1934.